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ABSTRACT

The equivalency of item sampling and student sampling of attitudes of college students was investigated. A factor analysis of student-sampled data collected during Spring 1968, was compared with a factor analysis of item-sampled data collected each quarter from Fall 1968, through Winter 1970, at Mankato State College, using the Campus Environment Study (CES) developed by the Central States Colleges and Universities Cooperative Research Program. In an earlier study item sampling was demonstrated to be equivalent to student sampling in terms of correlations of item means and standard deviations. It was also found that standard deviations of item-sampled responses were systematically smaller than for student sampling. When the results of that earlier study and the present one were compared, factor structures of student attitudes were found to be similar if not equivalent. Factors from item sampling had several common items on similar factors gained from student sampling. Item-sampled factors contained many items from the same a priori environments of the original item pool. The congruence of the items in the item-sampled factors was judged to be high, with some notable exceptions which could be attributed to the less than perfect intercorrelation matrix. An example of a typical item sample, consisting of six questions taken from the full 150-item CES is attached. (Author/TA)

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Closing the Communications Gap With Item Sampling

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INTRODUCTION

Serious questions have been raised about the strength and flexibility of our educational system. John Gardner has spoken of unloving critics, uncritical lovers and loving critics. Too many opportunities have been provided the unloving critics and uncritical lovers within and without our institutions of higher education. Few, if any, provisions have been made for the development of loving critics. Yet, if our institutions are to retain or gain strength, they must have the flexibility to respond to responsible input from the majority of patrons. Historically when students were allowed to engage in criticism, a sample of students was asked a population of questions. After receiving poor returns with limited opportunity for collecting responses regularly over a period of years, it has been decided there must be a better way.

Item sampling involves randomly selecting items rather than individuals and then administering the item samples to a population instead of with a sample of individuals. Item sampling has the potentiality of providing a voice for the silent majority. Lord (1955, 1960, 1962) laid the groundwork and demonstrated the practicability of item sampling for achievement testing applications. Lord (1962), Plumlee (1964), and Cook & Stufflebeam (1967) extended research on item sampling by using various size item samples and examinee samples. This study, as well as an empirical comparison of the validity of item and examinee sampling (Owens & Stufflebeam, 1967), indicated that a large number of examinees taking only a few items each provided a better estimate of the population norm than a small number of examinees answering many items each. Sax & Cromack (1966) and French & Greer (1964) have addressed

the context question and demonstrated that if the time limit is generous and the sample is short, context or the order of the items fades as a determinant of responses to the items. As Lord suggested in 1962, item sampling is being used to trade items for people in a wide variety of situations. It is being used in National Assessment (Merwin & Womer, 1969), achievement monitoring (Allen & Mackin, 1970) and in the U. S. census.

It is the purpose of this paper to investigate the equivalency of item sampling and student sampling of the structure of attitudes of college students. If we are to provide opportunities for the masses to respond to the concerns of higher education, we must provide a simple straight forward means of evaluating attitudes of our patrons. At a general session of the 1970 A.E.R.A. convention on problems and developments in research design and methodology in studying the college student, Howard Becker pointed out that the day of getting returns on 150-item inventories from college students is past. Alexander W. Astin suggested that C. Robert Pace and others were so concerned with reliability in the development of college environment scales when they utilized the agree/disagree response pattern (Pace & Stern, 1958) that they did not allow for measurement of change. It is unlikely that, in a short period of time, a student's response will shift abruptly from agree to disagree, but very possible that he might move from strongly agree to agree or uncertain on a five point scale.

To achieve this purpose, illustrative data from a "Campus Environment Study" will be presented. Factors from a factor analysis of item samples will be analyzed from the standpoint of the following questions: (1) Are the factors from item-sampled data similar to factors of student sampled data? (2) Are the item-sampled factors representative of items in a priori environments? (3) Are the items in the item-sampled factors congruent?

METHOD

Items from the Campus Environment Study (CES)* were item sampled and administered to students at pre-registration each quarter starting in Fall, 1968. Each item-sample contained six statements which were randomly selected from 150 items. During the academic year 1968-69 a stratified random sample was drawn, one item from each of six a priori college environments: Academic, Physical, Cultural, Communications, Community

*The writers wish to express appreciation to Dr. Herb Silvey of Central States College and University Cooperative Research Program for permission to utilize the pool of items from the Campus Environment Study.

Relationships and Moral-Ethical environments. During Fall, 1969, and Winter, 1970, the six items were drawn completely at random from the pool of items. (See Appendix A) At Mankato State College there were 5,958 item samples collected during Fall, 1968; 5,421 during Winter, 1969; 4,174 during Spring, 1969; 7,454 during Fall, 1969; and 7,690 during Winter, 1970 for a total of 25,276 representing over a 93 percent return from those pre-registering. A missing data correlation matrix program was developed by the co-author at the University of Minnesota. This "psuedo" matrix was then applied to a principal factor analysis and the factors rotated to meaningful structure with a varimax rotation program. Due to the "psuedo" matrix, a .40 rather than a .35 factor loading was used as a cutoff point. The factors thus obtained were compared with factors similarly obtained from a student sampled factor analysis based on data collected on all 150 items from 791 students at Mankato State College during Spring, 1968. (Petersen, 1969) The factors were also compared with the a priori scales of the CES and the congruence of items on each factor was interpreted.

RESULTS

Item sampling was demonstrated to be equivalent to student sampling in terms of correlations of item means and standard deviations in a previous study. (Petersen, 1969) It was also found that standard deviations of item-sampled responses were systematically smaller than for student sampling.

In the present study the "psuedo" correlation matrix, which was a result of intercorrelations of 25,276 six item samples, produced some factor loadings greater than unity. However, a previous factor analysis based on 15,144 item samples produced some factor loadings as great as 1.38, 1.17, 1.34, 1.25, 1.29 and 1.18. The high factor loadings in the present study such as 1.03, 1.08, 1.07, 1.10, 1.04, 1.07 and 1.18 are more tolerable but indicate a need for still more data. If the data collected in 1968-69 had not been based on stratified random sampling it is likely that fewer factor loadings would have exceeded unity.

In the tables which follow, the factors will be presented and the three questions relating to the purpose of the paper addressed for each factor. On the right of each table the factor number derived from the student sample factor analysis is listed. While this does not allow for a direct comparison of factor structures derived from student sampling and item sampling, it is all that can be accomplished at this time. The factors from the student sampled data are number I-X and the factors from the present study are number XI-XXI.

Factor XI in Table 1 is similar to Factors I and IV of the student sampled data. Factor I was a dimension involving warm

personal communications between and among students and faculty. Factor IV involved official, administrative type communication. The item sampled factor XI is a combination of the student sampled factors and four of the five items are from the a priori communications environment (items 76-100). The congruence of this factor is very high with all of the items dealing with concern and communication.

TABLE 1. Factor XI from Varimax Rotation Loadings of Principal Factor Analysis of the 150 Items of the Campus Environment Study at Mankato State College, Fall, 1968, through Winter, 1970

Item No.	Item	Factor Loading	Student Sampling Factors
93	The administration attempts to keep students informed on matters of policy.	1.03	IV
99	The administration informs faculty and students promptly of policy changes.	.80	IV
94	There is a friendly relationship between faculty and students.	.72	I
79	Generally, students feel quite comfortable in approaching instructors regarding a problem.	.47	I
107	The faculty on this campus is considerate and concerned with student problems.	.41	I

Factor XII is not similar to any of the student sampled factors except that it is made up of items from three different factors. Two of the three items are from the communications environment of the a priori scale and are congruent. All three items do not appear to have congruence with one another unless drinking habits can be related to communication.

TABLE 2. Factor XII from Varimax Rotation Loadings of Principal Factor Analysis of the 150 Items of the Campus Environment Study at Mankato State College, Fall, 1968, through Winter, 1970

Item No.	Item	Factor Loading	Student Sampling Factors
81	The administration and teaching faculty appear to cooperate well.	1.08	IV
127	Excessive drinking by students does not create a real problem on this campus.	.61	II
76	It is easy for students to communicate with the administration.	.44	I

Factor XIII has one item in common with factor VIII which was an organizational communications factor. The other two items are from the a priori physical environment. Two of the three items are congruent but the third is not.

TABLE 3. Factor XIII from Varimax Rotation Loadings of Principal Factor Analysis of the 150 Items of the Campus Environment Study at Mankato State College, Fall, 1968, through Winter, 1970

Item No.	Item	Factor Loading	Student Sampling Factors
34	The library is a good place to study.	1.07	
31	The campus has a very attractive appearance.	.71	
88	The student government is functioning satisfactorily.	.43	VIII

Factor XIV in Table 4 did not load on the student sampled factor analysis. All items are from the a priori academic environment. The items are exceptionally congruent, have high loadings and relate to good teaching.

TABLE 4. Factor XIV from Varimax Rotation Loadings of Principal Factor Analysis of the 150 Items of the Campus Environment Study at Mankato State College, Fall, 1968, through Winter, 1970

Item No.	Item	Factor Loading
21	Good teaching is a characteristic of most instructors at this institution.	1.10
18	Most instructors recognize a superior student and are willing to take extra time to challenge him.	.66
19	There is a good balance between idealism and other points of view in the classroom.	.65
4	Stimulating classroom discussions are frequent.	.64

Factor XV in Table 5 did not load on the student sampled factor analyses. All items are from the a priori academic environment. The items are congruent and indicate that this may be a scholarship dimension of the academic environment.

TABLE 5. Factor XV from Varimax Rotation Loadings of Principal Factor Analysis of the 150 Items of the Campus Environment Study at Mankato State College, Fall, 1968, through Winter, 1970

Item No.	Item	Factor Loading
6	High scholarship is a common goal of most students.	1.04
11	Examinations satisfactorily measure course assignments and presentations.	.56
8	Many students on this campus are striving for high grades.	.55
13	The academic atmosphere on this campus encourages students to go on to graduate work.	.52

Factor XVI is yet another academic factor which did not load on the student sample analysis. All five items are from the a priori academic environment. Most items are congruent and relate to dedicated teaching.

TABLE 6. Factor XVI from Varimax Rotation Loadings of Principal Factor Analysis of the 150 Items of the Campus Environment Study at Mankato State College, Fall, 1968, through Winter, 1970

Item No.	Item	Factor Loading
12	Most instructors here are dedicated teachers.	1.07
13	The academic atmosphere on this campus encourages students to go on to graduate work.	.56
2	Most instructors are very thorough in the teaching of their subject matter.	.50
19	There is a good balance between idealism and other points of view in the classroom.	.43
24	The institution provides a great many academic resources for student use.	.42

Factor XVII in Table 7 seems to be a community related physical environment dimension. The four items which loaded on the student sampled factor analysis each came from a different factor. Three items come from the a priori community relations environment (items 101-125), two from the physical environment, one each from the a priori cultural and communications environment. Despite the diversity, the items seem congruent in the community related physical area.

TABLE 7. Factor XVII from Varimax Rotation Loadings of Principal Factor Analysis of the 150 Items of the Campus Environment Study at Mankato State College, Fall, 1968, through Winter, 1970

Item No.	Item	Factor Loading	Student Sampling Factors
36	Off-campus housing facilities are satisfactory.	.92	
95	Rumors are quickly disspelled on this campus by ready access to facts.	.66	IV
109	The merchants in this community treat students like first class citizens.	.62	
54	Classical music is popular with the majority of students.	.54	VII
47	Housing costs are reasonable for the facilities and services provided.	.51	V
117	Upper classmen provide helpful leadership to new students.	.42	
105	The general atmosphere on campus is friendly.	-.67	

Factor XVIII relates favorably with factor II of the student sampled analysis. That factor was a large moral-ethical factor. The items are very representative of the a priori moral-ethical environment (items 126-150). The items on this factor are particularly congruent in the moral ethical dimension.

TABLE 8. Factor XVIII from Varimax Rotation Loadings of Principal Factor Analysis of the 150 Items of the Campus Environment Study at Mankato State College, Fall, 1968, through Winter, 1970

Item No.	Item	Factor Loading	Student Sampling Factors
138	Uncontrolled student behavior is not a characteristic of this institution.	.98	
126	Students respect institutional rules and regulations.	.74	II
111	There are ample opportunities to meet people through social functions and student organizations.	.61	
136	Institutional regulations do not place undue restraints on social conduct.	.40	V
74	In general the speech and habits of students reflect refinement and good taste.	.40	II
127	Excessive drinking by students does create a real problem on this campus.	.40	II

Factor XIX in table 9 does not relate to the student sampled analysis, although one item appeared on each of factors I and X. It does not relate well to any of the a priori environments except perhaps the moral-ethical domain. The congruence of the items relates to freedom of expression and openness for the most part but items on the use of drugs, library assistance and preparation for classes contradicts this interpretation.

TABLE 9. Factor XIX from Varimax Rotation Loadings of Principal Factor Analysis of the 150 Items of the Campus Environment Study at Mankato State College, Fall, 1968 through Winter, 1970

Item No.	Item	Factor Loading	Student Sampling Factors
7	Open mindedness and objectivity are characteristic of most classes.	1.00	
77	The expression of student opinions is encouraged.	.49	I
147	The use of hallucinatory drugs by students has not become widespread on this campus.	.49	
42	The library staff provides sufficient personal assistance in locating materials in the library.	.45	
130	Freedom of speech is an accepted practice on this campus.	.40	
9	Considerable out-of-class preparation by students is necessary for most courses.	.40	X

Factor XX related well with factors I and III of the student sampled analysis. Factor I was the warm personal communications factor and III a friendliness dimension. Three of the four items are from the community relationship environment of the a priori scale (items 101-125). The congruence of this factor relates to mutual respect and concern between and among students and faculty.

TABLE 10. Factor XX from Varimax Rotation Loadings of Principal Factor Analysis of the 150 Items of the Campus Environment Study at Mankato State College, Fall, 1968, through Winter, 1970

Item No.	Item	Factor Loading	Student Sampling Factors
122	The faculty, as a general rule, welcome student appeal for advice and counsel.	1.18	I
110	There is a feeling of mutual respect between students and faculty.	.54	I
112	Students show a concern for each other at this institution.	.50	III
78	Instructors are easy to approach with questions concerning classwork.	.49	I

Factor XXI does not relate to any of the student sampled factors except factor VII which while they have only one item in common seem both to be measuring student cultural opportunities. Seven of the eight items are from the a priori cultural environment (items 51-75). The congruence of this factor is exceptionally high and all of the items are related to cultural opportunities including recreation.

TABLE 11. Factor XXI from Varimax Rotation Loadings of Principal Factor Analysis of the 150 Items of the Campus Environment Study at Mankato State College, Fall, 1968, through Winter, 1970

Item No.	Item	Factor Loading	Student Sampling Factors
59	Dramatic presentations are given frequently on campus.	.89	
29	Recreational facilities are adequate to meet the needs of most students.	.49	
75	Artists and performing groups appear frequently on campus.	.45	
70	The library of tapes and records, i.e., music, poetry, etc., is used extensively by students.	.43	
64	There is opportunity to study cultures other than our own.	.42	
51	Opportunities are provided for students to evaluate works of art.	.40	
65	There are a variety of performing musical groups on this campus.	-.57	
56	Live performances of symphonies, ballet, and operas are well patronized by the students.	-.45	VII

All six of the a priori environments were represented in both factor analytical studies. As can be seen in Table 12, there were two more academically oriented factors among the student sampled factors. The academic factors were all small being comprised of five or fewer items. The communications environment split four ways in the student sampled analysis with a student newspaper and organizational communications failing to appear on the item sampled analysis. The other difference in number of factors was in the community relationships environment where two factors were identified with relatively few items which although in a majority on the factors, were from this environment.

TABLE 12. Number of Factors Gained in A Priori Environments from Varimax Rotations of Principal Factor Analyses of a Student Sample of Spring, 1968 and Item Samples of the 150 Items of the Campus Environment Study at Mankato State College, Fall, 1968 through Winter, 1970

Environment	Item Sample	Student Sample
Academic	3	1
Physical	1	1
Cultural	2	2
Communications	2	4
Community Relationships	2	1
Moral Ethical	1	1
TOTAL	11	10

DISCUSSION

The present results indicate that the structure of student attitudes are similar if not equivalent when measured with item sampling and student sampling. The student sample factor analysis was completed using Spring, 1968 data and the item sample analysis utilized data collected each quarter from Fall, 1968 through Winter, 1970. It is impossible to collect sufficient item sampled data on one medium sized campus during one quarter unless the population of items is reduced or the item sample size is increased.

Even with these limitations in the present study, several items load on similar factors. The item sampled factors load more consistently on items from the same a priori environments despite the fact that the contiguity or order of items is at random. The congruence of items loading on the same item sampled

factor is similar to student sampled factors with some notable exceptions. The exceptions may be related to the "psuedo" intercorrelation matrix but then the similarity also may be associated with the less than perfect matrix. By utilizing a .40 factor loading cutoff for inclusion in a factor this limitation was compensated for in part.

All of the a priori environments were represented in both factor analytical studies. There were two more academically oriented and two fewer communications oriented factors in the item sampled analysis than in the student sampled analysis. This difference may be accounted for by the temporal difference in when the data was collected. It may also be attributed to the factor analytical process itself.

The present study should be considered a pilot study or at most a developmental attempt to equate student sampling with item sampling. More research is needed. A proposed next step in the development of item sampling may also prove to be more conclusive. That would be to administer one complete 150 item inventory to a student sample for every 25 six item samples of the pool of items at the same time on several college campuses or at one large university. This would be superior to decreasing the population of items because one assumption of item sampling is that the items must represent all items which could be asked. It would also be superior to increasing the item sample size because six items is most optimum for fitting on one page and producing a very high rate of return.

In summary, factor structures of student attitudes were found to be similar if not equivalent. Factors from item sampling had several common items on similar factors gained from student sampling. Item sampled factors contained many items from the same a priori environments of the original item pool. The congruence of the items in the item sampled factors was judged to be high with some notable exceptions.

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Appendix A

DO YOU HAVE FOUR MINUTES TO HELP US BRIDGE THE COMMUNICATIONS GAP AT MANKATO STATE COLLEGE?
Here is your opportunity to respond to six items of vital campus concern. In total, 150 such questions will be answered by your fellow students utilizing this new Item Sampling Technique. This study is totally automated. Your responses on the computer printed items will be sorted by the characteristics listed below them and within a single day your assessment of these vital areas will be before your faculty and administration. BE SURE TO ANSWER EACH ITEM EXCEPT PERHAPS THE ONE OPTIONAL ITEM. PLEASE USE A COMMON NO. 2 PENCIL

YES! = STRONGLY AGREE yes = AGREE no = DISAGREE NO! = STRONGLY DISAGREE ? = UNCERTAIN

	YES!	yes	?	no	NO!
STUDENTS SHOW A CONCERN FOR EACH OTHER AT THIS INSTITUTION.				▬	
THE INSTITUTION HAS EXTENSIVE MUSEUM COLLECTIONS.				▬	
THERE IS STRONG STUDENT LOYALTY TO THIS INSTITUTION.			▬		
STUDENTS ON THIS CAMPUS HAVE AN EXCELLENT OPPORTUNITY TO GAIN AN APPRECIATION IN THE FINE ARTS.			▬		
CAMPUS FOOD SERVICES ARE SATISFACTORY.					▬
MEMBERS OF ALL RACES PARTICIPATE IN ALL CAMPUS ACTIVITIES ON AN EQUAL BASIS.		▬			

SEX 1 ▬ MALE 2 = FEMALE	▬	2			
CLASSIFICATION 1 = FRESHMAN 2 = SOPHOMORE 3 = JUNIOR 4 = SENIOR 5 ▬ GRADUATE	1	2	3	4	▬
MAJOR PROGRAM 1 = TEACHER EDUCATION 2 = NON-TEACHER EDUCATION 3 = UNCERTAIN	1	▬	3		
COLLEGE LIVING SITUATION (CHECK ONLY ONE) 1 = COLLEGE RESIDENCE HALL 2 = COMMUTER 3 = FRATERNITY/SORORITY 4 = MANKATO RENTER 5 = MANKATO RESIDENT	1	2	3	▬	5
PERMANENT RESIDENCE 1 = NE MINN. 2 = SE MINN. 3 = SW MINN. 4 = NW MINN. 5 = TWIN CITIES AREA BLANK = OUT OF STATE	1	2	3	4	▬
CUMULATIVE GRADE POINT AVERAGE 1 = BELOW C 2 = C TO C+ 3 = B- 4 = B 5 = B+ AND ABOVE	1	2	3	▬	5
PRIMARY SOURCE OF EDUCATIONAL EXPENSE 1 = FAMILY 2 = SAVINGS/SUMMER WORK 3 = ON/OFF CAMPUS WORK 4 = SCHOLARSHIP/GRANT/GI BILL 5 = LOANS	1	2	3	▬	5
MAJOR AREA 1 = ARTS & SCIENCES 2 = EDUCATION 3 = BUSINESS 4 = PHYSICAL EDUCATION 5 = NURSING BLANK = UNCERTAIN	1	2	▬	4	5
GROUP (OPTIONAL) 1 = AFRO-AMERICAN 2 = AMERICAN INDIAN 3 = CAUCASIAN AMERICAN 4 = ORIENTAL AMERICAN 5 = SPANISH AMERICAN	1	2	▬	4	5

MAKE NO MARKS BELOW THIS LINE

THESE PREPRINTED MARKS IDENTIFY THE ITEMS ABOVE WHICH WERE RANDOMLY SELECTED BY COMPUTER TO REPRESENT ALL 150 ITEMS.

MANKATO STATE COLLEGE

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